

CLAIMS

1. A very high-performance self-compacting concrete,  
5 comprising:

- a cement;
- a mixture of calcined bauxite sands of various particle sizes, the finest sand having a mean particle size of less than 1 mm and the coarsest sand having a  
10 mean particle size of less than 10 mm;
- silica fume, 90% of the particles of which have a size of less than 1  $\mu\text{m}$ , the mean diameter being about 0.5  $\mu\text{m}$ ;
- a defoamer;
- 15 - a water-reducing super plasticizer;
- optionally, fibers; and
- water,

characterized in that the silica fume represents at most 15 parts by weight per 100 parts by weight of cement, in that it further includes ultrafine calcium carbonate particles having a specific surface area of 10  $\text{m}^2/\text{g}$  or more, preferably of 15  $\text{m}^2/\text{g}$  or more and better still around 20  $\text{m}^2/\text{g}$ , and a form factor FF of 0.3 or more, preferably of 0.4 or more,  
25 and also characterized in that the cements, sands, ultrafine calcium carbonate particles and the silica fume have a particle size distribution such that there are at least three and at most five different particle size classes, the ratio of the mean diameter of one  
30 particle size class to that of the class immediately above being about 10.

2. The concrete as claimed in claim 1, characterized in that the ratio, by weight, of the amount of  
35 ultrafine calcium carbonate particles in the concrete to the amount of silica fume varies from 1/99 to 99/1 and preferably from 50/50 to 99/1.

3. A very high-performance self-compacting concrete, comprising:

- a cement;
- a mixture of calcined bauxite sands of various particle sizes, the finest sand having a mean particle size of less than 1 mm and the coarsest sand having a mean particle size of less than 10 mm;
- ultrafine calcium carbonate particles having a specific surface area of 10 m<sup>2</sup>/g or more, preferably of 15 m<sup>2</sup>/g or more and better still around 20 m<sup>2</sup>/g, and a form factor FF of 0.3 or more, preferably of 0.4 or more;
- a defoamer;
- a water-reducing super plasticizer;
- optionally, fibers; and
- water,

the cements, sands and ultrafine calcium carbonate particles having a particle size distribution such that there are at least three and at most five different particle size classes, the ratio of the mean diameter of one particle size class to that of the class immediately above being about 10.

4. The concrete as claimed in any one of the preceding claims, characterized in that the ultrafine calcium carbonate particles are ultrafine additions of calcium carbonate crystallized in the form of small cubes.

5. The concrete as claimed in any one of the preceding claims, characterized in that the cement is a white cement.

6. The concrete as claimed in any one of the preceding claims, characterized in that the mixture of calcined bauxite sands is formed by:

- a sand of mean particle size less than 1 mm, which includes 20% of fines smaller in size than 80 microns;

- a sand of particle size between 3 and 7 mm; and
- optionally, a sand of particle size between 1 and 3 mm,  
it being possible for the sand of smaller particle size  
5 to be completely or partly replaced with:
  - cement, mineral additions such as ground slag, fly ash or calcined bauxite filler, the mean diameter of which is less than 80  $\mu\text{m}$ , in respect of the 20% fraction of fines smaller in size than 80  $\mu\text{m}$ ; and
  - 10 - sand of particle size greater than 1 mm, in respect of the other fraction.

7. The concrete as claimed in any one of the preceding claims, characterized in that the fibers are  
15 chosen from metal, synthetic, organic or mineral fibers and mixtures thereof, preferably chosen from polyethylene, polypropylene, polyamide and polyvinyl alcohol homopolymer or copolymer fibers, carbon fibers, Kevlar® fibers and steel fibers.

20 8. The concrete as claimed in claim 7, characterized in that the fibers are metal fibers, preferably steel fibers, having a length of between 5 and 30 mm, preferably between 10 and 25 mm, and even  
25 more preferably around 20 mm, and having a diameter of between 0.1 and 1.0 mm, preferably between 0.2 and 0.5 mm, and even more preferably around 0.3 mm.

9. The concrete as claimed in any one of claims 3 to  
30 8, characterized in that it comprises, in parts by weight:

- 100 of cement;
- 50 to 200 of mixtures of calcined bauxite sands, of various particle sizes, the finest sand having a  
35 mean particle size of less than 1 mm and the coarsest sand having a mean particle size of less than 10 mm;
- 5 to 25 of ultrafine calcium carbonate and silica fume particles, the silica fume representing at most 15 parts by weight;

- 0.1 to 10 of defoamer;
- 0.1 to 10 of water-reducing super plasticizer;
- 15 to 24 of fibers; and
- 10 to 30 of water.

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10. The concrete as claimed in claim 9, characterized in that it comprises, in parts by weight:

- 100 of cement;
- 80 to 150, preferably 100 to 125, of mixtures of calcined bauxite sands, of various particle sizes, the finest sand having a mean particle size of less than 1 mm and the coarsest sand having a mean particle size of less than 10 mm;
- 10 to 20, preferably 13 to 17, of ultrafine calcium carbonate particles;
- 0.2 to 5, preferably 0.5 to 0.7, of defoamer;
- 5 to 7 of water-reducing super plasticizer;
- 17 to 20 of fibers; and
- 10 to 20, preferably 16 to 20, of water.

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11. The concrete as claimed in any one of the preceding claims, characterized in that it has a characteristic compressive strength of at least 150 MPa.

- 25 12. A method of preparing the fiber concrete as claimed in any one of claims 1 to 11, characterized in that all the constituents of the concrete are mixed together until a concrete of the desired fluidity is obtained or in that the dry granular constituents, such as the cement, the sands, the ultrafine calcium carbonate particles, the silica fume and optionally the super plasticizer and the defoamer, are firstly blended together, then in that the water and optionally the super plasticizer and the defoamer (if these are in liquid form), and optionally the fibers are added to this blend and in that these are all mixed until a concrete having the desired fluidity is obtained.

13. A concrete dry ready-mix, making it possible to obtain, after the addition of water, optionally fibers, and water-reducing superplasticizer and defoamer, if these are in liquid form, the concrete as claimed in 5 any one of claims 1 to 11.

14. The use of a concrete as defined in any one of claims 1 to 11 or as prepared using the method of claim 12 for the production of prefabricated elements such as 10 posts, beams, girders, floors, slabs, constructions, prestressed or composite components, keystones between structural elements, drain elements, or for architectonic applications.